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ENGINEERING AND EQUIPMENT

No. 28

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USSR AND EASTERN EUROPE SCIENTIFIC ABSTRACTS

ENGINEERING AND EQUIPMENT

No. 28

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ENGINEERING AND EQUIPMENT

No. 28

USSR

UDC 536.6.013.42

NONLINEAR OSCILLATIONS OF DEFORMED BODIES CONTAINING A LIQUID
AND MOVING IN SPACE

Kiev PRIKLADNAYA MEKHANIKA Vol 12, No 7, 1976 pp 62-69
manuscript received 5 Aug 75

BOYARSHINA, L.G., AND GANIYEV, R. F., Institute of Mechanics,
Academy of Sciences Ukrainian SSR, Kiev

[Abstract] The authors consider the coincident nonlinear oscillations of the surface of the liquid and of the deformed shell containing the liquid and moving in space. On the basis of a Hamiltonian variation principle it is shown that the equations of the nonlinear oscillations of the deformed shell with the liquid can be reduced to an infinite series of ordinary differential equations from which, as partial cases, certain previously unknown equations of oscillatory motions of bodies containing a liquid can be obtained. Ill 1 Biblio 12

USSR

UDC 532.69

STABILITY OF THE EQUILIBRIUM SURFACE OF A MAGNETIZABLE FLUID IN
A GRAVITATIONAL AND A MAGNETIC FIELD

Kiev PRIKLADNAYA MEKHANIKA Vol 12, No 8, 1976 pp 96-102
manuscript received 14 May 75

KELEBERDENKO, S.B., Institute of Mathematics, Academy of
Sciences Ukrainian SSR

[Abstract] The problem involves the determination of the stability of the equilibrium surface of a weakly magnetizable ideal incompressible fluid partially filling an axially symmetrical vessel of finite dimensions. The remaining volume of the vessel is assumed to be filled with a gas of negligibly low density. The fluid is in a magnetic field with intensity vector \vec{H} , a gravitational field $n\vec{g}$ ($g = 9.81 \text{ m/sec}^2$, $n =$ the overload factor) and under the effect of surface tension forces. The reciprocal influence of the fluid on the magnetic field is not taken into account. The axis of symmetry of the vessel is anticollinear to the vector \vec{g} . Basic equations are presented in a form that is convenient for engineering calculations for the case where the fluid is under the effect of nonuniform fields. Two methods are used for the solution of the stability

problem, and the results obtained by computer are tabulated. An analysis is made of the influence of the forces of the magnetic field on the stability of the equilibrium configurations of the fluid. The calculations show that the application of the magnetic field \vec{H} increases the stability of the surface in equilibrium when the orthogonality function $X < 0$ (diamagnetic fluid), but reduces stability when the function $X > 0$ (paramagnetic fluid). The latter (e.g., liquid oxygen) can be used to simulate zero gravity on the ground. With the diamagnetic fluid (e.g., liquid hydrogen) the state of equilibrium of the surface is close to critical for vessel radius $\alpha = \pi/4$ and Bond number $B = -2$. The application of a magnetic field characterized by $M = -5$ and magnetic-field non-uniformity $P = 0.5$ leads to a condition where the reserve of stability is greatly increased. Tab 4 Biblio 8

USSR

UDC 536.24: 532.54

INFLUENCE OF A CAVITY AT THE WALL OF A SUPERSONIC WINDTUNNEL ON ITS START-UP CHARACTERISTICS

Kazan' IZVESTIYA VUZOV AVIATIONNAYA TEKHNIKA No 3, 1976
pp 32-33 manuscript received Oct 75

KISLYAKOV, N. I., SHUSHIN, N. A., AND VINOGRADOV, B. S.

[Abstract] Results are given of an experimental study of the influence of the relative dimensions and configuration of a recess at one wall of a windtunnel on the structure of the supersonic flow in the recess area and on the start-up characteristics of the windtunnel. An increase in the relative dimensions of the recessed cavity leads to an increase in the required ratio of nozzle forechamber pressure to supersonic diffuser throat pressure for starting up the windtunnel. The start-up pressure ratio for a tunnel with a cavity rear wall slanted 45 degrees relative to the flow, or curved cavity rear wall, is improved by 10-11% over that of a rectangular cavity of the same length and depth. Ill 5 Tab 1 Biblio 8

USSR

UDC 532.526

EXPERIMENTAL STUDY OF FRICTION IN AXIALLY SYMMETRICAL DUCTS IN THE PRESENCE OF A LONGITUDINAL PRESSURE GRADIENT

Kazan' IZVESTIYA VUZOV AVIATIONNAYA TEKHNIKA, No 3, 1976
pp 50-55 manuscript received 15 Jan 75

KRASAVIN, V. M. AND FAFURIN, A. V.

Abstract Gas dynamical and electrochemical methods were used in the experimental study of friction in an axially symmetrical duct for both compression and expansion modes of fluid and gas motion. The experiments were conducted at the inlet portion of the duct and in the area of stabilized flow at Reynolds numbers $(3-6) \cdot 10^4$. The experimental device was a conical organic glass duct 250.65 mm long with outlet diameters of 43.12 and 51.25 mm. Nine cathode sensors were spaced every 25.6 mm in the test zone. Each cathode was a 0.3-mm platinum filament with a nickel plate welded to it as output contact. The experiments showed that a positive longitudinal pressure gradient leads to a considerable reduction of the coefficient of friction. For example, at a pressure gradient of $\lambda_0 \approx 22$ and Reynolds number $R^{++} = 2 \cdot 10^3$ the coefficient of friction (Ψ_λ) is only about 30% of its value at zero gradient. Ill 3 Tab 1 Biblio 7

USSR

UDC 533.697

GENERALIZED RAYLEIGH METHOD FOR ANALYZING THE STABILITY OF A TRANSLATIONAL-ROTATIONAL FLOW

Kazan' IZVESTIYA VUZOV AVIATIONNAYA TEKHNIKA No 3, 1976
pp 105-109 manuscript received 5 Feb 75

KHALATOV, A. A.

Abstract A simple procedure is proposed for generalizing the Rayleigh method of the translational-rotational motion of a flow. Here the fluid flows along a spiralling line and may be represented as a set of rotations of flow around an instantaneous center of velocities with a summary velocity W_s , which is a vector sum of translational, rotational, and radial variables of flow. The value of the instantaneous radius of curvature of rotation is determined from the equation $q = r/\sin^2 \vartheta$, where ϑ is the angle of twist at an arbitrary point. It is shown that for a vortexer designed on the basis

of the velocity law $W_0 \cdot r^n = \text{const}$, for stability condition $n > 1.0$, the centrifugal mass forces are conservative in the wall region. The stability of the vortex flow is reduced with increased intensity and initial angle of twist. Ill 1 Tab 1
Biblio 3

USSR

UDC 621.01

SOLUTION OF THE PLANAR PROBLEM OF AEROELASTICITY FOR AN AIR-SUPPORTED SOFT ENVELOPE

Moscow IZVESTIYA VYSSHIKH UCHEVNYKH ZAVEDENIY MASHINOSTROYENIYE in Russian
No. 8, 1976 pp 12-16 manuscript received 6 Feb 76

FOTINICH, D.I.

[Abstract] A soft envelope supported by internal pressure and immersed in a stream of liquid or gas is deformed under the influence of the pressure of the stream and the friction of the fluid against its surface. In this article, a study is made of planar flow around a soft cylindrical envelope. The flow is considered continuous. The interdependence of the form of the envelope and the external load resulting from the stream flowing transversely over the envelope requires successive determination. The equilibrium form of the envelope is produced by solving the problem of the theory of elasticity in displacements; the distribution of the external pressure over the surface of the envelope is found by minimizing the variational analogue of the Laplace equation. Aerodynamic friction in the boundary layer is determined from the impulse equation. 5 references.

USSR

UDC 621.458

COMPARATIVE ANALYSIS OF THE ECONOMIC CHARACTERISTICS OF CLOSED-CYCLE GAS TURBINE INSTALLATIONS WITH FAST NEUTRON REACTORS

Minsk IZVESTIYA VUZOV ENERGETIKA No 7, 1976 pp 84-89 manuscript received 12 Jan 76

GRIBOVSKIY, V. P., KLOK, A.M., AND TETEL'BAUM, S.D., Odessa Polytechnic Institute

[Abstract] In view of the fact that the literature on combinations of closed-cycle gas turbines and fast neutron reactors deals only with the efficiency of certain parts (e.g., heat exchangers) of the turbine, the authors present information on their attempts to estimate the influence of the thermophysical properties of working media on the comparative cost indices of such installations. For each of the working media (helium, carbon dioxide, and mixtures of the two) an optimum range of variation of reactor characteristics was selected from the point of view of power station efficiency. For example, for a given nuclear power station configuration it is economically advantageous to use carbon dioxide as the working medium at q_{\max} 6 Mw/m² and T_{\max} 1,140 K. Helium is efficient in the range of variation $q_{\max} = 2-6$ Mw/m², but only with much higher temperatures (1,700 K and above). For currently permissible fuel cell casing temperatures of 1,000 - 1,200 K and reactor core heat load of 2 - 3 Mw/m² the most effective working medium for power station efficiency is a mixture of certain heavy gases with helium. Ill 2 Tab 1 Biblio 12

USSR

UDC 624.074.4: 621.311.25: 621.039.539.3

INFLUENCE OF THE OPENINGS ON THE DEFORMED STATE OF THE REINFORCED CONCRETE SHIELDING OF A NUCLEAR POWER PLANT

Moscow BETON I ZHELEZOBETON No 8, 1976 pp 8-11

MIKHAYLOV, O.V., AND ZAYTSEV, V. N.

[Abstract] The deformed state of the nuclear power plant shielding is considered for the case where the shielding is subjected to an internal pressure in the area of openings that are arranged in a single vertical line and reinforced by a thickening of the wall on one side. The study was conducted on a large-scale model made of ordinary reinforced concrete. It was found

that in order to reduce the tensile stresses in the immediate vicinity of the openings to values below those that would lead to outer surface cracks, local thickening of the wall of the shield is required. The dimensions of the rectangular reinforcement should be selected so that its edges are 1.7 - 2.0 opening diameters from the center of the opening, and the additional thickness of the wall of the shielding should amount to 0.25 opening diameter. In the area of an opening the wall reinforcement must be analogous to that in the smooth area, with the same percentage reinforcement. The design and orientation of the reinforcement used in the experimental model increased the rigidity of the vertical zone of the shielding and caused, along the edges of the zone, a generation of annular bending moments which led to a bending of the zone inward relative to the adjacent zones. Ill 4 Biblio 3

USSR

UDC 539.3

ONE MECHANICAL MODEL OF AN EARTHQUAKE

Tashkent IZVESTIYA AKADEMII NAUK UZBEKSKOY SSR in Russian No. 5, 1976
pp 53-56 manuscript received 21 May 75

RAKHMATULIN, Kh.A., MARDONOV, B., IBRAIMOV, O., TURDIYEV, M., Moscow State University and Tashkent Polytechnical Institute

[Abstract] A study is made of the planar two-dimensional problem of sudden appearance in a linearly elastic medium of a straight-line, semi-infinite section of length $2l$ in a constant field of normal stresses. As a result of the formation of the section, a portion of the initial potential energy is converted to kinetic energy and unloading waves (seismic waves) propagate through the medium, possibly involving great acceleration of particles behind the leading edges of the waves. This straight-line section corresponds to the source (epicenter) of formation of shear earthquakes. 2 references.

USSR

UDC 621.643.001.24

FUNDAMENTAL ASPECTS OF DESIGNING PIPELINES FOR STRENGTH AND STABILITY IN ACCORDANCE WITH THE REQUIREMENTS OF THE NEW SNIIP STANDARD

Moscow STROITEL'STVO TRUBOPROVODOV No 8, Aug 76, pp 31-33

PROKOF'YEV, V.I., AND KAMERSHTEYN, A. G.

[Abstract] It is shown that the compilation of the new SNIIP construction norms and regulations has necessitated a thorough reexamination of the method used for computing the stress condition of pipelines in view of increased diameters and working pressures. The discussion here takes into account many factors that influence the structural limits, reliability and strength of pipelines. A relationship is derived that accounts for the following pipeline operating conditions: greater drops in temperature, increased loads, including axial loads caused by temperature effects plus internal pressure. According to USSR standards the safety factor for pipelines in the categories III and IV, depending on quality, varies from 1.7 to 1.9, whereas for USA and West German norms the safety factors for analogous conditions are 1.73 - 1.85 and 2 - 2.6, respectively.

Ill 1

USSR

UDC 621.315.592

THIN-FILM STRUCTURES WITH A Cu_2S -CdS HETEROJUNCTION

Tashkent GELIOTEKHNIKA in Russian No. 4, 1976 pp 5-10 manuscript received 25 Feb 75

AKRAMOV, Kh.T., STASHKOV, G.M., YULDASHEV, B.D., VISHCHAKAS, Yu.K., Tashkent State University; Institute of Geology and Geophysics, Acad. Sci. UzSSR

[Abstract] A study is presented of the production of photoelectric elements based on CdS films produced by the method of gas transport reactions. The CdS base film is analyzed. It is shown that the films have improved structure, the chemical composition is near stoichiometric. The technology of manufacture of Cu_2S -CdS film heterojunctions by the method of immersion of layers of CdS in an aqueous solution of CuCl is analyzed. A detailed study is presented of the influence of technological factors in the manufacture of the junctions on their properties. 7 references.

USSR

UDC 662.997:537.22(088.8)

DISTRIBUTION OF THE RADIANT VECTOR IN THE FIELD OF RADIATION OF A SPHERICAL CONCENTRATOR

Tashkent GELIOTEKHNIKA in Russian No. 4, 1976 pp 11-15 manuscript received 20 Sep 74

ZAKHIDOV, R.A., VAYNER, A.A., GAFUROV, A.M., Physics and Engineering Institute imeni S.V. Starodubtsev, Acad. Sci. UzSSR

[Abstract] A spherical concentrator, although it achieves less concentration than a parabolic concentrator, is attractive in that it can be made nonmoving with a moving receptor, greatly simplifying the design of a long-focus energy installation. The authors therefore calculate the distribution of the radiant vector for a spherical concentrator. It is found that the maximum irradiance of an ideal concentrator is 27.7% of the focal irradiance of an ideal parabolic concentrator with an aperture angle of 60° and an identical coefficient of mirror reflection. It is shown to be expedient to replace a long-focus parabolic mirror ($U_m \approx 30^\circ$) with a spherical mirror. 3 references.

USSR

UDC 662.997:537.22(088.8)

CONCENTRATING CAPACITY OF PARABOLIC FACETS

Tashkent GELIOTEKHIKA in Russian No. 4, 1976 pp 16-21 manuscript received
25 Apr 76

UMAROV, G.Ya., ZAKHIDOV, R.A., KHODZHAYEV, A.Sh., Central Planning and Design
Bureau for Scientific Instrument Building, Physics and Engineering Institute
imeni S.V. Starodubtsev, Acad. Sci. UzSSR

[Abstract] A facet concentrator is a system of individual mirror facets mounted on a carrier base so that the images of all of the mirrors are superimposed. This brings up the problem of studying the concentrating capacity of the mirrors with various angles of incidence of rays in planes perpendicular to the incident rays. A study is made of the formation of the image of a nonaxial, infinitely remote point light source by a parabolic mirror. Formulas are produced for calculation of the coordinates of points of intersection of reflected rays with a plane perpendicular to the rays incident to the mirror. Using the coordinates of the points of intersection calculated by an M-222 computer, image figures are constructed, aberrograms for mirrors with various aperture angles with various incident ray angles on various planes. 9 references.

USSR

UDC 523.72:536.21

ENGINEERING METHOD OF CALCULATION OF THE TEMPERATURE FIELD OF A FLAT NONMOVING RECEIVER PLACED AT THE FOCAL POINT OF A PARABOLIC CONCENTRATOR

Tashkent GELIOTEKHIKA in Russian No. 4, 1976 pp 22-28 manuscript received
4 Jul 75

AKHMEDOV, A.R., SMOL'SKIY, G.V., Institute of Electronics, Acad. Sci. UzSSR

[Abstract] One trend in the development of high temperature solar engineering is its use for melting, welding, soldering and other technological operations requiring local high temperatures. This requires a knowledge of the temperature fields around the heated spot. There is particular interest in the area near the focal spot, since knowledge of the temperature in this area allows determination of the dimensions of the melted bath. A method is suggested for calculation of the temperature field right up to the melting point when concentrated solar radiation acts on flat nonmoving receivers under conditions of complete through-melting. The method can be used for receivers of various metals using one-piece parabolic concentrators of various diameters and various manufacturing accuracies. 11 references.

USSR

UDC 662.997:537.22

SOLAR POSITION SENSORS UTILIZING LIGHT SELECTORS

Tashkent GELIOTEKHNKA in Russian No. 4, 1976 pp 29-33 manuscript received 5 Jul 75

BARANOV, V.K., State Optics Institute imeni S.I. Vavilov

[Abstract] A study was made of the possibility of creating a small radiation sensor with a strictly limited field of vision which could successfully be used as a sun position sensor. The basic element of the sensor is a fiber or multilayer light selector. It is shown that the combination of a fiber light selector with various radiation receivers allows the creation of a small sun position sensor having a number of advantages over ordinary designs. Results are described from testing of a model of such an instrument, confirming that the device does have a precisely limited field of vision and can be used as a light source position sensor. Fiber or layer selectors combined with fiber light guides form an instrument for recording of the position of the sun and its movements. The head of such an instrument can be installed on a moving platform, the recording portion on the nonmoving base, connected by fiber optics. The field of vision of the instrument can thus be made quite large. 2 references.

USSR

UDC 662.997.004.14

EXPERIENCE IN ESTIMATING THE RELIABILITY OF POWER SUPPLY SYSTEMS USING RENEWABLE SOURCES OF ENERGY BY MEANS OF BIMODAL DISTRIBUTION CURVES

Tashkent GELIOTEKHNKA in Russian No. 4, 1976 pp 57-62 manuscript received 2 Dec 75

SALIYEVA, R.B., Tashkent Electric Engineering Institute for Communications

[Abstract] A study is made of the mathematical description of the distribution function of the duration of the period of operation of an electric battery by means of a bimodal curve. The distribution function characterizes the distribution of the length of continuous functioning of the apparatus controlling the operation of the electric battery. This is important if we consider that 90-95% of the power consumed is provided by wind or solar power plants in combination with electric batteries. 9 references.

USSR

UDC 536.21

USE OF METHOD OF FINITE ELEMENTS IN DETERMINING THE TEMPERATURE
FIELDS IN STRUCTURAL ELEMENTS

Moscow MASHINOVEDENIYE No 5, 1976 pp 68-76 manuscript
received 6 Feb 76

PETUSHKOV, V.A. AND KUZNETSOV, S. F.

[Abstract] A general mathematical formulation of the finite element method is proposed as a generalized BUBNOV-GALKERIN method for solving the boundary value problems of the parabolic type. The boundary value conditions and thermophysical properties of the material are assumed to be time and temperature dependent. The use of spline functions is recommended for representing these dependencies in a computer. Questions regarding the accuracy and reliability of the finite element method are considered in conjunction with the related selection of the optimum approximation with respect to space and time. A sample numerical solution obtained with the Minsk-32 computer is given for the distribution of temperature fields in a cylindrical welded branch pipe of a reactor during shut-down cooling from an initial temperature of 300°C and temperature drop of 30°/hr. Ill 5 Biblio 10

USSR

UDC 536.25

ANALYTICAL STUDIES OF NONLINEAR INVERSE PROBLEMS OF HEAT
CONDUCTIVITY

Moscow IZVESTIYA AN SSSR ENERGETIKA I TRANSPORT No 4, 1976
pp 111-116 manuscript received 16 May 75

ALEKSASHENKO, A. A.

[Abstract] A method is given for determining the nonlinear thermophysical parameters without linearizing the heat conductivity equations. The method is based on qualitative investigations of the solutions of the nonlinear heat conductivity equations. Equations are given for the stationary and non-stationary self-similar solution for the case of constant values, and the method of obtaining the thermophysical parameters for the self-similar solution is illustrated graphically. It is shown that finding the thermophysical parameters from the

linearized equations can lead to both qualitative and quantitative errors. It is also shown that it is incorrect in principle to determine the thermophysical parameters on the basis of the mean integral, rather than local, values of the temperature fields. Biblio 5

USSR

UDC 536.2.01

ON THE SOLUTION OF PROBLEMS OF HEAT CONDUCTIVITY IN THE CASE OF VARIABLE COEFFICIENTS OF HEAT EXCHANGE

Moscow IZVESTIYA AN SSSR ENERGETIKA I TRANSPORT No 4, 1976
pp 117-126 manuscript received 10 Apr 75

TSOY, P.V., Dushanbe

Abstract A method is derived for an approximate analytical solution of the problems of nonuniform heat conductivity for both constant and variable heat exchange coefficients. A sufficiently precise functional dependence of the eigen values on the Bi-criterion of the heat conductivity equation is established without solving all of the characteristic equations. Representation of the temperature fields by simple analytic relationship affords the possibility of investigating effectively the thermoelastic stresses for various internal and external heat effects. The advantage of this method is demonstrated by comparison with well-known methods for both classical bodies and for multidimensional bodies of irregular form. The method can be used to solve problems where the coefficients of exchange vary in accordance with the coordinates and to solve internal problems of convective heat exchange for flow in straight ducts. Ill 4 Tab 3 Biblio 8

INCREASING THE RELIABILITY OF VOLUTE BURNERS WHEN BURNING HIGHLY REACTIVE FUELS

Moscow PROMYSHLENNAYA ENERGETIKA in Russian No 9, Sep 76 pp 21-22

IVANOV, S. A., engineer, and OSLOPOV, O. I., engineer, Ural'sk Branch of the All-Union Heat Engineering Institute

[Abstract] Burner outlet nozzles become partially burnt and the secondary air duct becomes blocked up with slag when boiler units equipped with turbulent-type burners with a volute entry for the aerated mixture and secondary air are used to burn highly reactive fuels. In this article simple and inexpensive measures are suggested to increase the reliability of volute burners. An analysis is made of the reason for the fact that intense burning up of the outer nozzles of double-volute burners is observed in BKZ-320 boilers when burning Kuznetsk and Gramoteino coal, as well as clogging of the secondary air ducts. It was found that the maximum temperatures of the outer nozzle's metal increase not in the lighting-up period, but, under ordinary operating conditions, during the operation of one or two dust conveyors. The temperature increases rapidly when a dust conveyor is turned on, and at this moment dust is drawn into the secondary air duct and it is ignited at the end of the outer nozzle. Negative pressure is created, giving rise to a return flow associated with the pressure gradient of the aerated mixture and secondary air at the burner's outlet when both flows are twisted intensely. To eliminate this phenomenon, it is suggested that the ignition zone be moved away from the burner by reducing the twist of the primary and secondary air, and also by opening up the burner jet and recirculation zone. The opening of the outlet port was reduced, two or three rectangular blades were installed on the rims of the secondary air duct, and the nozzles were lowered inside the burner. As a result the temperature of the metal of the outer nozzle was reduced 500 to 700°C. Fire-resistant nozzles were replaced with nozzles of ordinary steel. Clogging was eliminated. There was no increase in operating costs for the boiler. Figures 1.

USSR

UDC 534.1

STABILITY OF THE SYNCHRONOUS PRECESSION OF ROTORS OF CENTRIFUGAL PUMPS

Kiev PRIKLADNAYA MEKHANIKA Vol 12, No 8, 1976 pp 72-75
manuscript received 25 Jun 75

OVCHAROVA, D. K., AND GOLOSKOKOV, YE. G., Khar'kov Polytechnic Institute

[Abstract] On the basis of the fact that the highly viscous fluid in the circular eccentric slots of the seals of centrifugal pumps produces extreme hydrodynamic forces which change the critical velocity, reduce the amplitude of the resonance oscillations and, at high rpm, generate intensive self-excited vibrations, the authors study the influence of these hydrodynamic forces on the stability of motion of a rotor shaft with a single disk which is statically out of equilibrium. A stability criterion is obtained for the unbalanced rotor. The areas of stable and unstable shaft rpm are determined. The radial component of the hydrodynamic forces has no influence on the motional stability of the rotor. At a certain rpm ($W=2W_0$) an ideally balanced rotor loses stability. With increased static eccentricity of the disk the limit of stability shifts in the direction of higher angular velocities. For a relative static eccentricity of 0.6 the synchronous precession is stable at all rpm. Ill 3 Biblio 3

USSR

UDC 621.762

A CRITERIAL DEPENDENCE FOR THE HYDRAULIC DRAG FACTOR OF POROUS METALS

Moscow IZVESTIYA VYSSHIKH UCHEVNYKH ZAVEDENIY MASHINOSTROYENIYE in Russian No. 8, 1976 pp 77-80 manuscript received 4 Nov 75

BELOV, S.V., IR'YANOV, N.Ya., KARTUYESOV, O.G., POLYAYEV, V.M., Moscow Higher Technical School imeni N.A. Bauman

[Abstract] It is established that the hydraulic drag factor of porous metals depends on the flow mode of the liquid in the pores, the type of metal and its porosity. A method is suggested for producing a generalized criterial dependence for the hydraulic drag factors of porous metals as functions of the Reynolds number and porosity, correct for laminar, transient and turbulent flow modes of the liquid and gases in the pores. It is shown that the dependence of the hydraulic drag factor of porous metals on porosity is manifested only in the transient and turbulent flow modes.

THE FLOW OF A BINARY GAS MIXTURE IN A DIVERGING CONICAL DIFFUSER

Tashkent IZVESTIYA AKADEMII NAUK UZBEKSKOY SSR in Russian No. 5, 1976
pp 40-43 manuscript received 28 Nov 74

FAYZULLAYEV, D.F., ARIFOV, P.U., IRISBAYEV, K.N., BRENER, S.Ye., Institute of Electronics, Acad. Sci. UzSSR

[Abstract] A hydrodynamic study is made of the flow of a binary gas mixture in a diverging conical diffuser. The method used is based on the theory of Kh. A. Rakhmatulin for solution of the one-dimensional problem of flow of a mixture of two ideal gases in a conical diffuser. Expressions are produced for the change in velocity, density and concentration of both components. Based on the formulas produced, a numerical calculation is presented for a mixture of Ar (5%) and He (95%) at $P_0=100$ mmHg, $T_0=300$ K, $\alpha=45^\circ$. In spite of the approximations made, the qualitative effects produced agree with those observed in experiments with molecular beams. 4 references.

USSR

UDC 621-78.011

USE OF ELECTROTHERMIC TREATMENT TO INCREASE THE FATIGUE STRENGTH OF DRIVING AXLE GEAR CASINGS ON ZIL-130 AUTOMOBILES

Moscow AVTOMOBIL'NAYA PROMYSHLENNOST' in Russian No 9, Sep 76 pp 31-33

OGNEVSKIY, V.A., OSTROVSKIY, G.A., RYSKIND, A.M., and SHKLYAROV, I.N.,
Moscow Motor Vehicle Plant imeni I.A. Likhachev

[Abstract] The members of the gear casing of the rear axle of the ZIL-130 automobile consist of two die-forged halves welded together with a lengthwise seam to which the king pins are butt welded. Until recently these members were made of hot-rolled grade 40 sheet steel, 10 mm thick, with an 0.36- to 0.44-percent carbon content, and the king pins out of grade 40Kh steel. Heat treatment included normalizing with induction heating of the transverse butt weld followed by over-all hardening and high-temperature tempering of the entire gear casing. Cases of fatigue failure were observed, usually found in the branch sections of the gear casing's members. A new method of strain hardening has been suggested to lengthen the life and increase the reliability of gear casings, while at the same time reducing the cost and labor intensiveness of making them. Casing members are now made of 17GS steel, and the pins of grade 35 steel. Heat treatment is performed with induction heating and consists of the following operations: Normalizing the butt weld, quenching of the lower flanges of the members at sections extending about 400 mm from the flanges in the direction of widening, and tempering the flanges by heating areas on the side walls of the member. Comparative fatigue tests have shown that this new method, using the new grades of steel, results in an average life 2.5 times longer, as compared with the former. The new method of strain hardening results in a redistribution of residual stresses throughout the gear casing and the elimination of dangerous tensile stresses, replacing them with residual compressive stresses. The new heat treatment process makes it possible to improve the weldability of casing member halves and to eliminate the use of combined quenching and tempering units and peening, resulting in savings of energy, materials, labor, and space. A line for thermic strain hardening of rear-axle gear casings for the ZIL-130 automobile has been introduced at the Serdobs Machine-Building Plant of the AvtoZIL Association. Figures 3; tables 2; references 2: 2 Russian.

USSR

UDC 533.6.011: 534.8.001.5

ON DETERMINING THE MACH NUMBER AND CRITICAL VELOCITY IN FLOWS
WITH RELAXATION PROCESSES AND SONIC DIFFUSIONS

Minsk IZVESTIYA VUZOV ENERGETIKA No 7, 1976 pp 104-111
manuscript received 15 Jan 76

STEKOL'SHCHIKOV, YE. V., Moscow Power Engineering Institute

[Abstract] A study of the mechanism of the formation of a gradient flow of a compressible fluid by external effects showed that the generation and sustaining of any gradient flow, including stationary flow, in a system described by Euler coordinates is caused by sound waves belonging to a class of natural oscillations. An engineering method is presented for computing local sonic velocity and Mach number in flows of relaxing, diffusing media, as well as for computing the coordinates of the critical cross section of the duct. The method is given in linear approximation, and is illustrated by a numerical example. Ill 1 Biblio 9

USSR

UDC 621.01

KINEMATICS OF A THREE-DIMENSIONAL TWO-LINE GROUP

Moscow IZVESTIYA VYSSHIKH UCHEVNYKH ZAVEDENIY MASHINOSTROYENIYE in Russian
No. 8, 1976 pp 71-76 manuscript received 25 Dec 75

OVAKIMOV, A.G.

[Abstract] Earlier studies analyzed kinematically a three-dimensional four-axle mechanism, the driven portion of which is a two-element group with three cylindrical couples. In this article, the solution of the problem of the positions of this group is presented in general form, i.e., with no relationship to any specific mechanism. Therefore, the formulas presented can be used to determine the position of elements in the group in question in any mechanism with one or more degrees of freedom. Furthermore, a special criterion delta can be used to select a solution corresponding to the assembly (configuration) of the group in question. Illustrative examples are presented. 3 references.

USSR

UDC 621.165.002.6

HEAT STATE PROBLEMS FOR THE ELEMENTS IN THE PLANNING SYSTEM FOR
LARGE STEAM TURBINE INSTALLATIONS

Moscow IZVESTIYA AN SSSR ENERGETIKA I TRANSPORT No 4, 1976
pp 85-92 manuscript received 18 Apr 73, revised 16 May 75

SHUBENKO-SHUBIN, L.A., AND PEREVERZEV, D. A.

[Abstract] For the systematic planning of larger steam turbine installations a solution that is amenable to modern computer capabilities is suggested for the problems of the heat state of the elements and increased mode versatility. The urgency and possibilities of such an approach to the solution is demonstrated on the basis of expected future demands for greater output efficiency and operational versatility. Fundamentals are given of mathematical models for determining the relative elongation of the rotor for transient modes and optimum turbo-generator loading. The procedure is given for obtaining information now lacking and for increasing this information on the basis of the models in the direction of successful planning and operation of larger steam turbine units. Biblio 18

USSR

UDC 616.001.21

STUDY OF THE ELECTRICAL SAFETY AT A MINING-METALLURGICAL PLANT
UNDER ARCTIC CONDITIONS

Moscow PROYMSHLENNAYA ENERGETIKA, No 5, 1976 pp 22-26

MAKSIMENKO, N. N., ASEYEV, G. G., AND UVAROV, O.I., Noril'sk
Evening Industrial Institute

[Abstract] An analysis of the general plan of the facilities and metallic communications networks at the Noril'sk Mining and Metallurgical Combine showed that all the substation grounding circuits have a metallic connection with the industrial communications networks and with one another and thus form a single grounding network. It is shown that the parameters of the substation grounding circuits must be standardized for arctic conditions, with the influence of natural grounding taken into account, and that the conditions for electrical safety on the substation premises and beyond and the conditions for explosion safety in the underground workings be analyzed. The permissible

contact potentials (shockproof potentials) should be the criterion of electrical safety. Summer conditions should be the basis for the computations since the thawing of the grounding stratum greatly reduces the contact resistance between the human body and the ground, which in turn greatly lowers the permissible contact potential. Ill 4 Biblio 5

USSR

UDC 621.311.22: 632.15.002.234

OUTPUT LIMIT OF AN ELECTRIC POWER STATION WITH RESPECT TO AIR CONTAMINATION BY OXIDES OF SULFUR AND NITROGEN

Minsk IZVESTIYA VUZOV ENERGETIKA No 8, 1976 pp 57-62
manuscript received 10 Feb 76

POPOV. A.I., Saratov Polytechnic Institute, and TYAPCHENKO, V. K., Belorussian Department, All-Union Scientific and Research Planning Institute of the Power Engineering Industry

Abstract From the point of view of the contamination of the atmosphere by oxides of sulfur and nitrogen during the burning of sulfur- and high-sulfur fuel oils, the authors derive, for determining the output power limit of thermal electric power plants using organic fuel, formulas which account for the total effect of the various components, qualitative indices of the fuel and specific characteristics of the region in which the power station is sited. Calculations show that in the majority of cases at large thermal electric power plants exhaust stacks 250 meters and 350 meters high do not satisfy the requirements for protecting the surrounding atmosphere from contamination. In future plans the stacks will have to be at least 500 meters high. Ill 1 Tab 1 Biblio 5

AUTOMATIC FORMATION OF LOGICAL DIAGRAMS FOR CLASSIFYING THE STATES OF COMPLEX RELATIVELY SELF-CONTAINED SYSTEMS

Tashkent IZVESTIYA AKADEMII NAUK UZ SSR, SERIYA TEKHNIЧЕСКИХ НАУК No 4, 1976 pp 13-17 manuscript received 26 Apr 74

KHALIKOV, D.M., and DUNAYEVSKIY, A.V., Military Engineering Academy imeni F.E. Dzerzhinskiy

[Abstract] In this article it is shown that it is possible to automate completely a type of intellectual activity like forming algorithms for making a logical diagnosis of the states of complicated equipment systems. The procedure of forming logical classification algorithms is carried out in practice by human beings and requires colossal labor costs and results in algorithms which are not adaptable to changing conditions and do not hold in abnormal situations. Here an analysis is given of the problem of automatically forming these algorithms as applied to a specific class of large systems, called complex relatively self-contained systems. The ideas contained can be used for making a technical diagnosis of any complicated system which can be broken down into units in a certain way. The technic for solving the problem involves representing mathematical models of system modules by various module nets. The algorithm for diagnosing the state of the entire system is equivalent to the algorithm for classifying the state of a certain module net. The procedure involved amounts to testing in sequence the states of specific outputs of individual modules. One positive and a certain number of negative decisions are formed on the state of the module net, and each logical testing condition or each final result represents a node on a graph. A three-step algorithm is used to solve the problem and has been implemented with the M-200 computer. The implications of the notions presented here for cybernetics are emphasized. References 5: 5 Russian.

USSR

UDC 621.186.3.004.65

DAMAGES TO BENDS OF 12Kh1MF-STEEL HIGH-PRESSURE STEAM PIPES

Moscow ELEKTRICHESKIYE STANTSII No 4, 1976 pp 28-31

SOLOMAKHA, M. A., and ALDAKUSHIN, P. I.

[Abstract] Tests have shown that the bends are the least reliable portions of these steam pipes and that the bends have different mechanical properties than the straight sections, i.e., higher strength properties but lower ductility than the straight sections. At ordinary operating temperatures (550-570°C) the steel in the bends weakens, and short (rarely over 100 mm) intercrystalline cracks develop along the axis of ultimate rupture, which in most cases is in the form of longitudinal splitting. The authors cite the inadequacy of the 1973 Regulations and call for a single document for standardizing the method, extent, and periodicity of tests of pipe bends that will include all factors influencing reliability. They further call for methods of measuring residual strains at bends and in straight sections. In bends of 273-mm dia pipe with wall thickness of up to 20 mm the formation of cracks under working pressure of 100 kg/cm² and temperature of 540°C should be considered a danger sign, and the bends should be replaced. It is also recommended that the bends in steam pipes that have been tested in accordance with the 1973 Regulations only at the straight sections be replaced, particularly in installations where frequent start-stop operations are the rule. Ill 5 Tab 1 Biblio 5

USSR

UDC 621.186.3 : 620.17

PECULIARITIES OF THE CHANGES OF STRUCTURE AND PROPERTIES OF 12Kh1MF STEEL WITH REDUCED STRENGTH

Moscow ELEKTRICHESKIYE STANTSII No 6, 1976 pp 45-47

ZLEPKO, V.F., SHVETSOVA, T.A., and MELAMED, M. M., All-Union Institute of Heat Engineering

[Abstract] It is shown that age-hardening processes in 12Kh1MF steel steam pipes operating at 540°C and above are not completed during the rated period of use (30,000 hrs); this is verified by the increase of the average diameter of the carbides and increase in the number of particles per unit of microsection surface when the period of use is extended to 50,000 hours.

The increase of particle number and formation of dislocation lattices stabilize the properties of 12Kh1MF steel; thus the short-time and long-time strengths do not change when the period of use is extended from 25,000 to 50,000 hours. One apparent reason for this stabilization in the extended period is the strengthening influence of the separating secondary phases of the metal in the process of polygonization, which was observed after 44,580 hours of use. These strengthening processes reduce the effect of the weakening processes (spheroidization, depletion of the solid solution by the alloying elements, coagulation) in the steel. Ill 4 Tab 1 Biblio 4

USSR

UDC 621.186.7

INFRARED SPECTROSCOPIC INVESTIGATION OF THE STABILITY OF REFRIGERATING OIL KhF-22-24 DURING THERMAL AGEING

Moscow KHOLODIL'NAYA TEKHNIKA, No 8, 1976, pp 19-21

GORLINA, L.P., ZAKHARKINA, N.S., and ZAYEV, N. E., All-Union Scientific Research Institute of Electromechanics

[Abstract] Although freons and mixtures of freons and oils affect the electrical and mechanical properties of insulating materials, a full appraisal of the electrical properties of insulating materials is possible, according to the authors, only by accounting for the reciprocal affect of the insulating materials on the oil-freon mixture. The purpose of this study was to determine the behavior of KhF-22-24 refrigerating oil in a medium consisting of inert gas and freon-22 during heating in the presence and absence of insulating materials. It was found that mineral oil KhF-22-24 is unstable to the extended affect of the thermal ageing temperature of 150°C in the mixture of inert gas and freon-22 as a result of the breakdown of the additive vinipol. Insulating materials based on polyimide film have practically no influence on the physicochemical properties of KhF-22-24 oil during extended temperature effects at 150°C in a freon-22 medium. The presence in electrical insulation of polyester base materials, which are unstable to oil-freon mixtures at 150°C reduces the usefulness of the KhF-22-24 oil. Ill 4 Biblio 5

USSR

UDC 621.186.7

RESTORATION OF THE FINE STRUCTURE AND PROPERTIES OF 12Kh1MF
STEEL AFTER LONG USE

Moscow TEPLOENERGETIKA No 8, 1976 pp 69-71

TRUSOV, L.P., BEREZINA, T.G., BOGATYREV, YU. M., YEREMINA, V.P.,
UPOROVA, V.A., ASHIKHMINA, L.A., and LEPEKHIN, A.Z.

Abstract In 12Kh1MF-steel steam pipes during a period of up to 100,000 hours of use a decomposition of the solid solution is observed, along with the precipitation of dispersed special carbides and the development of processes of regression resulting in the formation in the ferrite of low-angle sub-boundaries of both globular and reticular structure. All structures of the pipes studied had micropores. Repeated heat treatment led to a formation of ferrite-sorbite structure, with some ferrite fragmentation retained. Some of the micropores closed. The rest distributed themselves inside the grain as a result of the recrystallization of the structure. Repeated heat treatment brought the short- and long-time properties of the investigated 12KhMF steel pipes up to values acceptable by the MRTU 14-4-21.67 Standard. Ill 3 Tab 3
Biblio 9

USSR

UDC 621.791.01: 669.15-194.2: 620.192.4.669.788:
620.168.33

INFLUENCE OF HYDROGEN ON THE STATIC STRENGTH AND DUCTILITY OF
LOW-ALLOYED STEELS 09G2S and 17GS (AS APPLIED TO THEIR WELDING)

Moscow SVAROCHNOYE PROIZVODSTVO No 8, 1976 pp 7-9

SUVORIN, V.YA., NIKOLAYEV, A.F., STREKALOV, V.A., SHUKAYLO, V.I.,
and FROLOV, V.V.

Abstract Notched specimens of 09G2S (0.11%C; 1.35%Mn; 0.60%Si; 0.031% S; 0.025%P) and 17GS (0.18%C; 1.44%Mn; 0.52% Si; 0.034% S; 0.020% P) steels at various stages of preliminary thermomechanical treatment were tested for the influence of hydrogen on strength and ductility. 09G2S was found to be more sensitive to hydrogen than 17GS. High-temperature tempering in air, and particularly in vacuum, considerably reduced the influence of hydrogen dissolved in the metal on the strength and ductility of both types of steel. Ill 2 Biblio 9

USSR

UDC 621.791.052: 669.295: 669.788

HYDROGEN SEGREGATION IN THE SEAM AREA OF WELDED JOINTS OF TITANIUM ALLOYS

Moscow SVAROCHNOYE PROIZVODSTVO No 8, 1976 pp 9-11

MURAV'YEV, I.I., KOLACHEV, B.A., and TAFINTSEV, YE.A.

[Abstract] The diffusion of hydrogen in a welded joint of titanium alloys was determined on the basis of three diffusion flows: thermal diffusion in the direction from the seam to the base metal, interphase diffusion from the alpha phase to the beta phase, and intraphase diffusion along the fusion (alloying) line. The effect of these flows leads to three maxima of hydrogen content in the welded joint. The welding mode has a great influence on the rediffusion of hydrogen in the heat-affected zone. The soft mode leads to more favorable diffusion of hydrogen than the hard mode. In the case of argon-arc spot welding the hydrogen segregation in the heat-affected zone and along the fusion (alloying) line is more pronounced than with continuous argon-arc welding. Ill 4 Biblio 8

USSR

UDC 621.791.72.052: 620.17: 669.14.018.44

INFLUENCE OF WELD-METAL ALLOYING DURING ELECTRON BEAM WELDING ON THE PROPERTIES OF THE WELDED JOINT OF THE HIGH-TEMPERATURE ALLOY KhN73MBTYu

Moscow SVAROCHNOYE PROIZVODSTVO No 8, 1976 pp 24-27

MOROCHKO, V.P.

[Abstract] In order to avoid the formation of weld-metal cracks during electron beam welding the author tested a method of alloying the weld metal by introducing thin butt strips before welding. The alloying elements thus were distributed uniformly across and along the weld, except for the transition layers between the base metal and weld metal. By alloying the weld metal of the age-hardening nickel-base alloy Kh73MBTYu (EI 698) with alloy VKh4A, as well as with molybdenum and vanadium, it was possible to prevent cracking in the weld area, while preserving the high mechanical properties of the welded joint. The success of this procedure, as opposed to the failure of alloying with tungsten, niobium and VKh6 alloy, is explained by the increased ductility

of the weld metal compositions and reduction of the temperature gradients between the solidus temperatures of the weld metal and of the base metal. Ill 8 Tab 2 Biblio 10

USSR

UDC 621.791.052: 536.485: 669.14.018.395

COLD RESISTANCE OF WELDED JOINTS OF LOW-ALLOYED HIGH-STRENGTH STEELS

Moscow SVAROCHNOYE PROIZVODSTVO No 8, 1976 pp 27-30

KASATKIN, B.S., TERESHCHENKO, A.F., MARTSENKO, YE.V., STRIZHIUS, G.N., and SOVA, A.D.

[Abstract] A study was made of the resistance to brittle fracture of the welded joints of high-strength steels 14Kh2GMR (0.12%C; 1.10%Mn; 0.27%Si; 0.44% Mo; 1.50% Cr; 0.05 % Ni; 0.08% Cu; 0.04%V; 0.023% S; 0.023% P) and 12GN2MFAYu (0.14% C; 1.20% Mn; 0.53% Si; 0.19% Mo; 0.50% Cr; 1.51% Ni; 0.07% V; 0.10% Al; 0.016% N; 0.023% S; 0.015% P) under static and impact loading at temperatures down to -60°C. The results demonstrate the good weldability and high mechanical properties of these steels at low temperatures. Parts, such as excavator hand levers, made of these steels have a service life 2.7 - 2.8 times that of similar parts made of conventional low-alloyed steels 09G2 and 10KhSND. The resistance to crack propagation in the studied steels is approximately twice that of steel 09G2. Ill 6 Tab 1 Biblio 7

USSR

UDC 666.14.018.44.001.5: 620.172.251.2

INFLUENCE OF PLASTIC DEFORMATION ON THE CYCLIC CREEP STRENGTH OF A HIGH-TEMPERATURE ALLOY

Leningrad ENERGOMASHINOSTROYENIYE No 9, 1976 pp 18-21

GETSOV, L.B., KONONOV, K.M., and REBYAKOV, YU.N.

[Abstract] Authors present an analytic description of the regularities of the joint influence of cyclic plastic deformation and cyclic creep on the EP 220 high-temperature alloy used in gas turbine blades. Cyclic-creep curves show that with alternating deformation involving creep the alloy EP220 is cyclically

unstable in contrast to its behavior during cyclic elastic-plastic deformation without creep. The cyclic-creep curves stabilize with increased number of half cycles. The magnitude of the creep deformation that builds up as a result of the irregular creep in the stable cycle with constant cycle time is approximately twice the creep deformation of the material in the initial state. In tests with given creep deformations per cycle this deformation in the stable cycle is reached at a rate up to 47 times the rate in the zero half cycle. Although the creep behavior of EP220 during cyclic deformations is characteristic also for other nickel-base high-temperature alloys, for unhardened materials such as AIL1316 steel and cobalt-alloyed L-605 the influence of prior plastic deformation on cyclic-creep strength may be just the opposite. The reason for the behavior of these materials is the fact that the obstructions to the movement of the dislocations (Lommer-Cottrell barrier, e.g.), that are generated under the effect of repeated plastic deformations, have much greater influence on the creep rate than an increase in the number of active dislocations.

Ill 6 Biblio 12 Tab 2

USSR

UDC 621.791.052: 669.293.5: 621.78

EFFECT OF HEAT TREATMENT ON THE PROPERTIES OF WELDED JOINTS OF NIOBIUM ALLOYS OF THE SYSTEM Nb-1Zr-C

Moscow SVAROCHNOYE PROIZVODSTVO No 8, 1976 pp 30-32

AFEF'YEV, YU.V., CHERNYSHOVA, T.A., and POKOSOV, V.S.

Abstract A study was made of the influence of heat treatment modes on the properties of the metal in the welded joints of three niobium base alloys: alloy 512 (0.96%Zr; 0.006% O; 0.008% N; 0.001% H; 0.009% C), alloy 917 (1.01% Zr; 0.024% O; 0.025% N; 0.001% H; 0.024% C) and alloy 918 (1.10% Zr; 0.025% O; 0.026% N; 0.001% H; 0.12% C). Heat treatment at 800 - 900°C leads to a decomposition of the solid solution of the weld metal, accompanied by reduced ductility and impact toughness. The decomposition of the solid solution leads also to a relatively pure alloy containing only 0.025% impurities. Rehardening by heat treatment is feasible for welded joints of the alloys with hydrogen content under 0.1%. In the weld metal of the alloy with 0.12% C (alloy 918) the decomposition of the solid solution during heat treatment occurs primarily as precipitation of the niobium carbides Nb₃C₂ and Nb₂C. During rehardening there is a preferred precipitation of Nb₂C. Ill 2 Tab 2 Biblio 6

USSR

UDC 669.28.620.17

INFLUENCE OF HEAT AND MECHANICAL TREATMENT ON THE STRUCTURE AND LAYER SEPARATION
TENDENCY OF MOLYBDENUM ALLOYS

Kiev PROBLEMY PROCHNOSTI in Russian No. 9, 1976 pp 87-93 manuscript received
5 Apr 75

DANYUSHCHENKOV, I.A., LIZUNOV, V.A., MINAKOV, V.N., TREFILOV, V.I.

[Abstract] A study is made of the conditions of generation and development of layer separation during bending testing of an alloy of molybdenum containing 0.02% C and 0.08% Zr. It is shown that in the deformed state, the alloy shows clear heterogeneity of distribution of carbon through the thickness of sheets, which is retained following annealing and subsequent rolling. The heterogeneity of distribution of carbon is a result of two mutually complimentary factors: diffusion redistribution of impurities under the influence of the stress field in the process of plastic deformation and conservation of the heterogeneity of the initial ingot in the form of flattened grain boundaries rich in interstitial impurities and carbide phase particles. Generation of a crack, leading to layer separation, occurs at grain boundaries in areas with elevated carbon content. A study is made of the possible mechanism of formation of a crack, related to difficulties in stress relaxation in the boundary layer. It is established that in order to produce a metal with no tendency toward crack formation, the deformation technology should provide for even distribution of the interstitial impurity through the thickness of the sheet. 13 references.

USSR

UDC 431.3

INFLUENCE OF RESIDUAL STRESSES CAUSED BY CHROME PLATING AND CYANIDING ON THE
ENDURANCE OF TYPE Kh17N2 STEEL

Kiev PROBLEMY PROCHNOSTI in Russian No. 9, 1976 pp 116-117 manuscript received
19 Mar 75

TRESKUNOV, B.A., V.Ya. Chuvar' Metal Products Plant

[Abstract] Results are presented from determination of residual stresses and the endurance limit of Kh17N2 steel after chrome plating and cyaniding. An analytic dependence is established between the endurance limit and residual stresses, allowing prediction of the influence of protective layers on the endurance limit. Chrome plating of the steel produces tensile stresses, cyaniding produces compressive stresses. The residual tensile stresses caused by shiny chrome plating reduced the endurance limit by 19.5%, by matte chrome plating -- by 11%. The compressive stresses produced by cyaniding increase the endurance limit by 39.5%. 9 references.

USSR

UDC 620.184;539.43

SOME PECULIARITIES OF THE FORMATION OF THE STRUCTURE OF FRACTURE SURFACES
IN FATIGUE RUPTURE

Kiev PROBLEMY PROCHNOSTI in Russian No. 9, 1976 pp 121-123 manuscript received
11 Jun 75

SOSNOVSKIY, L.A., MARCHENKO, V.G., RAB, V.M.

[Abstract] Results are presented from studies of secondary effects under conditions of symmetrical bending in one plane using specimens of type 45 carbon steel and with alternating extension and compression of the shaft of a large piston compressor manufactured of type 38KhMA improved steel. Analysis of the fractures reveals secondary slipping bands on the fracture surfaces, resulting from cyclical deformation due to the external load on the rupture surfaces after passage of the fatigue crack. 4 references.

USSR

UDC 666.1

GLASSES WITH LOW THERMO-OPTICAL CHARACTERISTICS P AND Q

Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST' in Russian No. 7, 1976
pp 32-34 manuscript received 1 Aug 75

SHCHAVELEV, O.S., BABKINA, V.A., YELINA, N.N., DIDENKO, L.A., MIT'KIN, V.M.,
MOLEV, V.I.

[Abstract] The most probable values of W are determined in the area of wavelengths of the spectrum of cadmium at 70 C, corresponding to the zero values of the thermo-optical characteristic P at a wavelength of 1.06 μm , temperature of 30 C and various levels of value of mean dispersion of the index of refraction ($n_F - n_C$) of silicate and phosphate glasses. The mean square error in values of W, presented in Table 1, can be considered to be $2-4 \cdot 10^{-7} \text{ deg}^{-1}$. The need and methods for development of athermal glasses with low thermo-optical characteristic Q with low P are demonstrated. The properties of activated lead-phosphate glasses developed by the authors are presented. These glasses have P varying between -3 and $+3 \cdot 10^{-7} \text{ deg}^{-1}$ and Q of $1.0-1.5 \cdot 10^{-7} \text{ deg}^{-1}$ at 30 C and 1.06 μm . The glasses are rather inert to fused quartz and platinum, allowing them to be produced in quartz vessels with capacities of up to 100 l under production conditions, yielding an absorption factor of 0.0008 cm^{-1} . 16 references.

SELECTION OF TYPE OF HIGH SPEED STEEL FOR THE MANUFACTURE OF HIGH QUALITY BROACHES

Moscow IZVESTIYA VYSSHIKH UCHEVNYKH ZAVEDENIY MASHINOSTROYENIYE in Russian No. 8, 1976 pp 120-123 manuscript received 19 Jan 76

SAMOFALOV, Yu.I., POKROVSKIY, V.P.

[Abstract] This article presents the results of studies performed at the cutting laboratory of the Department of the Theory of Mechanical Working and Tools of the Moscow Higher Technical School imeni N.E. Bauman. The life of flat broaches manufactured at the Moscow Tool Plant of high speed steel of 12 different types was studied. All of the broaches were triple tempered at 560 C, the austenite grain size checked to assure minimum deformation with the required hardness and heat resistance. The greatest resistance was that of broaches of type R9K10 and R12F3 steels, which were 30 and 12% respectively longer lived than broaches of R18 steel. Next longest lived were broaches made of steels types R6M5, R6M5K5, R6F2K8M5 and R12F5M, slightly better than R18 steel. Broaches made of steels types R9F5 and R8M3K6S were equivalent to R18 steel broaches. Poorest were R12F3K10M3, R9M4K8 and R12F2K8M3 steels. The two superior steels had the following chemical compositions (%): R9K10 0.96 C, 0.15 Mn, 0.36 Si, 4.15 Cr, 10.2 W, 2.2 V, 9.2 Co, 0.7 Mo, 0.17 Ni, hardened from 1220 C, HRC 64-65; and R12F3 0.96 C, 0.1 Mn, 0.36 Si, 3.69 Cr, 12.78 W, 2.7 V, 0.7 Mo, 0.16 Ni, hardened from 1240 C, HRC 62-63.

USSR

UDC 771.376.35

BASIC STATEMENTS OF EXPONOMETRIC METROLOGY

Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST' in Russian No. 7, 1976
pp 9-12 manuscript received 30 Apr 75

DAVYDKIN, I.M.

[Abstract] This article is dedicated to analysis of the problem of development of standardized methods for determining the possibility of using various types of exposure-measuring devices, standardized technical requirements for them, matching of their characteristics with the output parameters of the exposure meter as a whole, normalization and testing of parameters of light-measurement elements based on the statements of exponometry. These same principles should be used as the basis for methods of measurement of characteristics of devices and their elements, as well as methods of evaluation of the results of measurement. Differences are noted in the nature of the requirements placed on light measurements by the problem of exposure measurement, and the basic statements of exponometric metrology related to consideration and evaluation not only of the effects of light, but all of their types of effects as well, are presented. A system of evaluation of changes in parameters and errors inherent in exponometry is studied. 3 references.

USSR

UDC 535.853.4

MEASUREMENT OF AMPLITUDE-PHASE DISTRIBUTIONS OF LIGHT FIELDS BY A RAYLEIGH INTERFEROMETER

Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST' in Russian No. 7, 1976
pp 12-14 manuscript received 15 Aug 75

SALAMOV, I.V.

[Abstract] A rayleigh interferometer is described in which the measurement of the amplitude-phase function of the light field in the optical channel is performed by optical heterodyning of the signal. Experimental results are presented. The use of optical heterodyning of the signal and of a phase-shifter-compensator allows phase measurements of light fields to be performed with arbitrary amplitude distribution by a direct and highly accurate method. This provides the possibility for recording amplitude distributions, increasing, in particular, the dynamic range of measurements with constant current characteristics of the photodetectors. With a narrow photodetector diaphragm, the position of the reference and measurement channels has no influence on the output signal. This allows the study of amplitude-phase characteristics both of the entire optical channel and of its elements, including the Fourier lens. The primary shortcoming of the interferometer consists in the significant losses involved in formation of the "working" signal and the lower accuracy of amplitude measurements in comparison to phase measurements. 6 references.

USSR

UDC 681.1.088: 519.2

PROBABILITY DISTRIBUTIONS OF THE DETERMINATIVE ERROR VALUE OF A MEASURING DEVICE WITHIN THE MEASUREMENT RANGE

Moscow METROLOGIYA No 7, 1976 pp 3-8

RYBAKOV, I.N.

Abstract For a given measurement means the author plots graphically those determinative error value distributions nearest to the permissible limit for a measurement range where a set of different initial distributions exists at each point of measurement. Certain specific characteristics of the determinative value distributions and their usefulness in practical metrology are described. The distributions of determinative error values differ at each point of the measurement range in accordance with the number of measurement points. For all initial distributions, including the normal, the type of distributions of the determinative errors is bimodal and differs more radically from the normal with increasing number of measurement points. The change of the distributions with increased number of measurement points is such that the determinative error values corresponding to the same level of probability increase rapidly. If an original distribution changes the limiting error values, the reliable probability of correct indication by the measurement means is $P_{rel} = 0.8 - 0.9$, i.e., close to the limit value. Ill 4 Biblio 6

USSR

UDC 681.2.088 - 501.12

ON ESTIMATING THE ACCURACY OF LINEAR MEASUREMENT SYSTEMS INTENDED FOR THE DISTORTION-FREE REPRODUCTION OF SIGNALS

Moscow METROLOGY No 7, 1976 pp 9-16

FEDOSEYEV, V.N.

Abstract For estimating the accuracy of linear measurement systems a method is suggested for which the differential equations do not contain the derivatives of the input signal. The method is based on an analysis of the distribution of the maximum irregularity of the amplitude-frequency characteristic and nonlinearity of the phase-frequency characteristic within the operating frequency band. The system error is computed on the basis of the mean square criterion. Ill 2 Biblio 14

USSR

UDC 620.17.088: 621.762

ESTIMATING THE RELIABILITY OF THE RESULTS OF MEASUREMENT OF THE MECHANICAL PROPERTIES OF MATERIALS IN POWDER METALLURGY

Moscow METALLURGIYA No 7, 1976 pp 27-33

BOGODUKHOV, S.I., GAYDUCHENKO, A.K., KISELEV, B.P., and RABINOVICH, I.B.

[Abstract] The authors show that the absence in the GOST 18227-72 standard of the permissible limit of curvature of tensile test specimens can lead to considerable errors in the measurement of the mechanical properties of materials in powder metallurgy. Reasons are given for the great number of specimens required for testing. Proposals are made for making the above standard more reliable. Ill 1 Tab 2 Biblio 9

USSR

UDC 543.812: 678.632'32'21

DETERMINING THE MOISTURE-CONTENT OF THE PHENOL FORMALDEHYDE RESIN DURING THE TECHNOLOGICAL PROCESS OF MANUFACTURING ARZAMIT-5 LUBRICANT

Moscow METROLOGIYA No 7, 1976 pp 59-63

LEONT'YEV, YE.A., MURASEV, N.V., and KLAUZNER, G.M.

[Abstract] A new method is suggested for a rapid determination of the moisture content of the phenol formaldehyde resin used as a binder in the production of the anti-corrosion lubricant "Arzamt-5". The method has been tested under both laboratory and industrial conditions. The error in the determination of the moisture content is $\pm 0.5\%$ abs; a determination takes approximately five minutes. The results are comparable to those obtained with the Dean-Stark method. Biblio 2

USSR

UDC 621.1.088.001.24

COMPUTING THE ERRORS OF MULTI-RANGE MEASURING DEVICES

Moscow METROLOGIYA No 9, 1976 pp 3-9

KUNDRYASHOVA, ZH.F.

[Abstract] A method is proposed for computing the distribution of the maximum absolute error value of multi-range measuring devices in which the random errors are negligible by comparison with the systematic errors. The computation is based on the known errors of the units and components, which affords the possibility of determining the probability of devising multi-range instruments with an error lower than the above computed error. An example computation is given. Ill 2 Biblio 5

Stress Analysis

USSR

UDC 620.178.16-519.2

THE RELATIONSHIP OF THE DISPERSION OF STRENGTH PARAMETERS TO HETEROGENEITY OF MICROSCOPIC DAMAGE FOCI

Kiev PROBLEMY PROCHNOSTI in Russian No. 9, 1976 pp 27-30 manuscript received 12 Jun 75

TATSIY, V.G., STREL'NIKOV, V.P., KUZIN, Ya.G.

[Abstract] An attempt is made to produce quantitative relationships between the dispersion of certain strength parameters and microheterogeneity of the processes of deformation and wear. The basic theoretical conception utilized is the statistical concept of strength; the experimental basis is the results of investigation of microheterogeneities in the processes of deformation and wear; the mathematical apparatus used is the theory of Markov random processes. The statistical equivalence of the ensemble of macrospecimens and the ensemble of microspecimens ("primary" elementary objects) for determination of the distribution of such important parameters as the yield point, fatigue durability and durability in normal wear is demonstrated. The optimal size of a microspecimen is the correlation interval of microdamage foci. The variation factor of distribution of certain strength parameters of structural materials is found to be equal to the variation factor of distribution of microdamage foci. 12 references.

USSR

UDC 539.4.01

EXPERIMENTAL CHECK OF THE CRITERION OF MAXIMUM EQUILIBRIUM OF A CRACK OR NARROW SLIT LOCATED IN A FLAT STRESS STATE FIELD

Kiev PROBLEMY PROCHNOSTI in Russian No. 9, 1976 pp 36-39 manuscript received 22 Jan 75

PAVLOV, P.A., NIKULINA, N.Ye.

[Abstract] The theoretical conditions of equivalence of various planar stress states leading to the development of local quasibrittle rupture at the tip of a crack or thin slit are experimentally checked. The study is performed on flat and tubular specimens of polymethylmethacrylate with artificial concentrators. It is established that with an open crack, all conditions of equivalence predict data which agree well with the experimental results. It is noted that these conditions may also be extended to the case of a thin elliptical slit. With a closed crack, the possibility of correct predictions depends on the reliability of the coefficient of friction of the opposite sides, which may change from 0 to 0.2 or higher. 7 references.

USSR

UDC 621.181.021 - 634.2: 539.56

HYDROGEN EMBRITTLEMENT OF THE METAL IN TGM-85 BOILERS

Moscow ENERGETIK No 2, 1976 pp 27-28

TOLSTOV, A.M., and SALAMATINA, A.I.

[Abstract] An analysis was made of the causes of five cases of accidental bursting of the shield pipes of two TGM-84 boilers within a period of several days. It was found that in oil-fired boilers with burners near the side shields there is a danger of shield-tube rupture, without preliminary deformation, as a result of hydrogen embrittlement. Some measures are proposed for preventing this from happening. Ill 1 Biblio 1

USSR

UDC 539.376

ON THE THEORY OF CREEP IN INHOMOGENEOUSLY HEREDITARILY AGEING MEDIA

Moscow DOKLADY AKADEMII NAUK SSSR, Vol 229, No 3, 1976 pp 569-571 manuscript received 10 May 76

ARUTYUNYAN, N.KH., Academy of Sciences Armenian SSR

[Abstract] Fundamental rheological equations for homogeneously hereditarily ageing media given previously by the author (NEKOTORYYE VOPROSY TEORII POLZUCHESTI -- Some Questions of Creep Theory -- Moscow-Leningrad 1952) are generalized here for the case of inhomogeneity on the basis of the technological conditions involved in the preparation of actual structures where the ageing of the material relates to space coordinates. It is this relationship that causes the inhomogeneity of the hereditarily ageing media, which, in turn, determines the type of functions that characterize the prompt-elastic deformation $E(\tau)$ and creep deformation $C(t, \tau)$ for such media, depending on the space coordinates. Biblio 4

USSR

UDC 539.4.013

STRESS STATE AND LOAD CONCENTRATION AROUND A HOLE DURING
COMPLEX LOADING

Moscow MASHINOVEDENIYE No 5, 1976 pp 63-67 manuscript
received 8 Apr 76

MAVLYUTOV, R.R., ROKITYANSKAYA, I.V., and MARDIMASOVA, T.N., Ufa

Abstract A method is described for computing the stress and strain states in structural elements under elastic-plastic conditions during simple and complex loading. A finite element method is used for the numerical solution of the problem, and a method of successive stresses is used to obtain the complex loading of the parts. For the elastic-plastic problem based on the deformation theory of plasticity, a method of variable elasticity parameters is used to obtain a solution at each step of the loading. The method is illustrated by a calculation of the stress state in a plate with a circular hole under simple and complex loading. The succession of loads on the plate with the hole has considerable effect on the stress and strain states. With multistep loading the level of the stresses in the zone of plastic deformation is lower than with simple loading. The residual stresses in the zones of concentrated stresses depend on the succession of load applications. Ill 4 Biblio 4

USSR

UDC 539.3

TRANSFER OF FORCES FROM A STRINGER OF VARIABLE RIGIDITY TO
A REINFORCED SHELL

Kiev PRIKLADNAYA MEKhanika Vol 12, No 7, 1976 pp 3-10
manuscript received 6 Aug 74

MAKSIMENKO, V.N., and FIL'SHTINSKIY, L.A., Novosibirsk

Abstract The study involves a reinforced shell strengthened by a periodic system of stringers of variable cross section for the case where at the end of each stringer a concentrated force is applied along the axis. The problem of determining the contact forces of interaction of stringer and shell is reduced to the solution of a singular integral differential equation. The question of the equistable stringer is explained as an inverse problem of significance wherever reinforced thin-walled structures are involved. Results of calculations with the M-222 computer

show an advantage of approximately 50% over stringers of the same length with constant cross section. Ill 2 Biblio 9

USSR

UDC 539.3

DISTRIBUTION OF STRESSES IN AN ELASTIC PLATE WITH UNIFORMLY STRESSED REINFORCEMENT

Kiev PRIKLADNAYA MEKHANIKA Vol 12, No 7, 1976 pp 33-38
manuscript received 17 Jan 75

BOGAN, YU.A., and NEMIROVSKIY, YU.V., Institute of Hydrodynamics, Siberian Department Academy of Sciences USSR, Novosibirsk

Abstract A study is made of the distribution of stresses in an annular plate reinforced by two sets of thin wires strung at different angles to the radius vector. The reinforcing wires are assumed to be uniformly stressed, i.e., the stress values in the wires are constant and, in the general case, coincide for the different sets of wires. The materials of the binding and of the reinforcement are assumed to be elastic. It is also assumed that the medium is in a state of either plane strain or generalized plane strain. Hyperbolic quadratic equations are derived for the Erie function. Partial cases are analyzed where the plate degenerates into a continuous disk and into an infinite surface with a circular hole. It is shown that in the absence of a load on the periphery of the hole, the concentration of stresses can be either greater or less than the classical, depending on the configuration of the reinforcing wires, i.e., the appropriate choice of reinforcement-wire orientation and level of permissible stresses in the wire can lead to reduced stress concentration. Biblio 4

USSR

UDC 531.11: 621.824.5

REACTION OF SELF-OSCILLATING SYSTEMS TO A PULSE ACTION

Kiev PRIKLADNAYA MEKhanika Vol 12, No 8, 1976 pp 76-83
manuscript received 27 Aug 75

ANIK'YEV, I.I., and KOVAL'CHUK, P.S., Institute of Mechanics
Academy of Sciences Ukrainian SSR

[Abstract] An asymptotic integration method is used to solve the problem of parametric and harmonic synchronization of self-oscillating systems subjected to impulsively applied constant loads. The possibility of partial or complete damping of the resonance oscillations in such systems is demonstrated. The external impulse was applied to the system at the moment when oscillations close to the harmonic were generated in the system, and the motion of the system was studied at pure resonance. For two parameters, $k_1=17/16$ cm and $k_2=55/16$ cm ($h=0.1$, $w=4$ sec⁻¹) the oscillograms showed that after the impulsive load was applied the resonance oscillations of frequency $v=2w$ decayed completely in the case of k_1 , whereas with k_2 only a shift in the equilibrium position of the system occurred; the amplitude at the new position remained the same as before the load was applied. The same results occurred in the case of the harmonic effect. Ill 5 Biblio 7

USSR

UDC 539.3

BUCKLING OF A MULTILAYER MEDIUM WITH A CIRCULAR CYLINDRICAL CAVITY

Kiev PRIKLADNAYA MEKhanika Vol 12, No 8, 1976 pp 31-35
manuscript received 22 Nov 74

MALITS, P.YA., Simferopol State University

[Abstract] An algorithm is given for an analytical solution of problems of axially symmetrical buckling of bodies made up of a finite number of elastic layers and having a circular cylindrical cavity. The problem is reduced to a plotting of several compliance functions by recurrent formulas. The author investigates the position and character of the compliance bands and zero compliance functions by means of contour integration of the integrals obtained in the computing process. The problem of the

buckling of a base made of two layers of equal thickness is given as an example, wherein the following apply: 1) all zeroes and bands of the compliance function of a multilayer base on an inelastic half space $C_n(p)$ are ordinary, lie on the minor axis and alternate; 2) the compliance function of a multilayer base on an elastic half space $C_n(p)$ for $\text{Re } p \geq 0$ has no zeroes and no bands; 3) the properties of the compliance function $D_n(p)$ coincide with the properties of the compliance function of a multilayer packet on an inelastic half space $C_n(p)$; 4) the compliance function $E_n(p)$ has no zeroes in the complex plane; all of its bands are ordinary and lie on the minor axis.
 Ill 4 Biblio 3

USSR

UDC 534.11: 621.824.5

THEORETICAL DETERMINATION OF THE WAVEFORMS AND FREQUENCIES OF THE NATURAL OSCILLATIONS OF A TWISTED FLEXIBLE SHAFT

Kiev PRIKLADNAYA MEKhanika, Vol 12, No 8, 1976 pp 64-71
 manuscript received 6 Jun 75

KOLESNIKOV, K.S., and NIKOL'SKAYA, ZH.A., Moscow State Univ.

Abstract The natural oscillations are studied in a twisted flexible-wire shaft with a jacket around the position of equilibrium in which the elastic line of the shaft is part of a circle. The shaft has constant resistance to torsion and variable bending strength, depending on the radius of curvature of the elastic line and applied torque. A solution for a system of differential equations in partial derivatives and a method for theoretical determination of the natural waveforms and frequencies of the oscillations are given. Ill 1 Biblio 2

USSR

UDC 539.3

CONTACT PROBLEMS FOR AN ELASTIC SPACE WITH A SPHERICAL CAVITY

Kiev PRIKLADNAYA MEKHANIKA Vol 12, No 8, 1976 pp 23-30
manuscript received 31 Oct 74

KARPENKO, V.A., Scientific-Research Institute of Mechanics and Applied Mathematics, Rostov State University

[Abstract] The problem is considered of the impression of a rigid axially symmetrical die in an isotropic elastic space with a spherical cavity. It is assumed that the surface of the spherical cavity is not loaded beyond the contact zone, and that friction is absent in the contact zone. For determining the contact pressure an integral equation of the first type is used, which is then regularized and reduced to an integral Fredholm equation of the second type, which is solved by an asymptotic method. A numerical solution is given for spherical dies. A comparison with a Hertzian solution shows that for large contact areas the use of the Hertzian solution leads to appreciable errors. Ill 4 Tab 1 Biblio 5

USSR

UDC 539.376+539.4

THE KINETICS OF HARDENING AND VULNERABILITY OF A DEFORMABLE SOLID TO DAMAGE

Tashkent IZVESTIYA AKADEMII NAUK UZBEKSKOY SSR in Russian No. 5, 1976
pp 34-39 manuscript received 11 Nov 75

FEDOROV, V.V., Tashkent Institute of Railroad Transport Engineers

[Abstract] A study is made of certain results of the investigation and description of the kinetics of deformation hardening and damage vulnerability of a solid using thermodynamic and molecular-kinetic concepts. In accordance with dislocation theory, the process of plastic deformation and rupture of a solid involves the generation, motion, interaction and accumulation of various types of elementary defects and damage sites. Using a combined approach involving both thermodynamic and molecular-kinetic concepts, a study is made of the kinetics of deformation hardening and damage vulnerability of a solid. A kinetic equation of state of the solid is produced, describing the kinetics of deformation hardening, as well as the volumetric damage vulnerability of actual materials in the process of plastic deformation and rupture, which agrees with the experimental data in this area. 10 references.

USSR

UDC 621.438 - 235.5

STUDY OF HEAT EXCHANGE IN TURBINE BLADE LATTICES DURING EFFUSIVE COOLING

Kazan' IZVESTIYA VUZOV AVIATIONNAYA TEKHNIKA No 3, 1976
pp 28-31 manuscript received 16 Oct 75

DEZIDER'YEV, S.G., KARIMOVA, A.G., LOKAY, V.I., and SHCHUKIN, A.V.

Abstract A description is given of an experimental stand for studying heat exchange from a gas to various parts of turbine blade lattices during air cooling through pores (effusive cooling). A heated gas was used as the working medium, and cooling was done with clean compressed air. The Reynolds number of the gas varied between $8 \cdot 10^5$ and $3.1 \cdot 10^6$; gas temperature 318 - 350 K; cooling-air temperature 290-300 K. The turbine blades used were made of solid textolite and a porous nickel-chromium powdered alloy, 120 mm long with a 135-mm chord. A method was devised for conducting the experiments and for processing the obtained data. A gradient method was used for determining the heat transfer coefficients. Some results are given of a generalization of the experimental data by a method of local modelling. Ill 3 Tab 1 Biblio 2

USSR

UDC 536.5.62 - 226.2

ON DETERMINING THE EQUILIBRIUM TEMPERATURE OF BLADES IN A HIGH VELOCITY FLOW

Moscow IZVESTIYA AN SSSR ENERGETIKA I TRANSPORT No 4, 1976
pp 127-132 manuscript submitted 3 Apr 75

KOPELEV, S.Z. and GUROV, S.V.

Abstract Several questions are considered that relate to the determination of the equilibrium temperature of a gas flowing with a high longitudinal velocity gradient around turbine lattices. Experiments were conducted with three lattices with blade lengths 100, 157, and 220 mm, gas temperatures of 670-1,470 K, and gas pressures of $0.2-8 \cdot 10^5$ Pa, which corresponds to a variation of $Re = (0.45 - 6.0) \cdot 10^5$; the Mach number varied from 0.41 to 0.98. The recovery factors determined experimentally applied to the turbine lattices in the range of gas flow parameters that occur within a turbine. It is shown that two

characteristic regions exist with respect to the Reynolds number: one self-similar region where the recovery factor remains invariable, and one region where the recovery factor drops with decreased Re. It is found that the recovery factor at the turbine blades is a single-valued function of the Reynolds number of the flow and can be essentially different from unity, which must be taken into account in a determination of local heat exchange coefficients along a lattice profile.
Ill 4 Tab 1 Biblio 5

USSR

UDC 621.165.532.507

STUDY OF THE TURBULENCE OF A FLOW IN A TURBINE LATTICE ERODED BY SALTS AND METALLIC ACIDS

Minsk IZVESTIYA VUZOV ENERGETIKA No 7, 1976 pp 77-83
manuscript received 30 Oct 75

LEONKOV, A.M., and ZOLOTAREVA, V.A.

Abstract The structure of the turbulence of flow in the blading of a turbine with varying surface roughness of nozzles and rotor blades caused by salt deposits was studied on a mock-up of the K-300-240 LMZ ten-stage turbine in a windtunnel at the Steam and Gas Turbines Laboratory of the Department of Thermal Electric Power Stations, Belorussian Polytechnic Institute by the standard method of processing experimental data for plane blade rows. The results show that the deposits have a considerable effect on the structure of the flow of the working medium which, in turn, influences the losses in the flow section of the turbine. Data are also obtained which explain the reasons for the salt deposits on the blading. Numerical expressions describing the dependence of turbulence on surface roughness were obtained from a processing of the experimental data on the MINSK-32 computer. Ill 5 Tab 1 Biblio 5

USSR

UDC 621.438.62 - 57

STUDY OF THE START-UP MODES OF THE GT-35 GAS TURBINE INSTALLATION

Moscow TEPLONERGETIKA No 8, 1976 pp 57-60

OL'KHOVSKIY, G.G., POLOVOTSKIY, L.V., KAPLAN, M.P., BUMARSKOV, A.O., BELOV, A.I., CHERNOMORDIK, L.I., and KORZH, P.I.

Abstract The start-up and loading problems of the gas-turbine section of the PGU-200 steam-gas installation in the independent mode as well as in joint operation with the steam-gas installation were solved in the initial acceptance period at year's end 1972-73. Data from tests during this period were later processed to obtain the design characteristics of the compressor, turbine, and total turbine installation, as well as of the output power and characteristics of the steam starter turbine during the start-up of the gas turbine installation. The results of these studies were the basis for selecting the starter engine and for estimating the start-up parameters of the independent GT-35 units slated for the Yakutsk Power Plant. The start-up characteristics of the main parts of the gas turbine installation are given, and their operational peculiarities are analyzed. The influence of various factors on these start-up characteristics is appraised. Recommendations are given for enhancing the start-up characteristics of the total unit, and possibilities of using a more efficient starter. Ill 5

USSR

UDC 62-565

STABILIZATION OF THE ANGULAR MOTION OF A BODY WITH A SECOND
PENDULUM

Kiev PRIKLADNAYA MEKhanIKA Vol 12, No 8, 1976 pp 126-130
manuscript received 25 Dec 74

KRAVETS, V.V., Dnepropetrovsk Branch, Institute of Mechanics,
ACADEMY OF SCIENCES UKRAINIAN SSR

[Abstract] The mechanical system under consideration consists of a rigid solid body and two pendulums, one of which is free. Mechanically the system is equivalent to a body with a cavity partially filled with a liquid. The stabilization of the angular motion of the body moving under the effect of a follow-up force is realized by adjusting the position of a second pendulum by an internal control force that is varied in accordance with a linear algorithm. The possibility of stabilizing the angular motion of the body and of the pendulums is demonstrated. The variable parameters of the control algorithm are determined. Ill 1 Biblio 5

USSR

UDC 531.389

DRIFTS OF A SINGLE-AXIS GYROSTABILIZER ON AN OSCILLATING PLATFORM

Kiev PRIKLADNAYA MEKhanIKA Vol 12, No 8, 1976 pp 130-133
manuscript received 28 Jan 75

DZHAGAROV, G.A.

[Abstract] The author considers the case of the drifts of a monaxial gyrostabilizer with ideally balanced two-degree-of-freedom gyroscope on the gimbal of which a flywheel is firmly mounted. The gyrostabilizer is attached to a platform that oscillates on its unstabilized axes. The study falls within the precession theory of gyroscopes. Here the drifts of the gyrostabilizer are considered in relation to the three-dimensional orientation of the free kinetic moment vector of the flywheel, with internal friction moments along the stabilization axis and output axis of the gyroscope taken into account. Generalized formulas are obtained for the drifts of a monaxial gyrostabilizer on a vibrating base for the case where the flywheel attached to the gimbal is oriented arbitrarily in space.
Ill 2 Biblio 2

COMPARISON OF ENERGY EFFICIENCY OF VARIOUS TYPES OF HEAT EXCHANGERS

Kazan' IZVESTIYA VUZOV AVIATIONNAYA TEKHNIKA No 3, 1976
pp 60-65 manuscript received 15 Oct 75

LOKAY, N.V.

Abstract Author suggests that the comparison of the energy efficiencies of various heat exchanger types (recuperators, regenerators, including rotary types) be done on the basis of an energy efficiency factor that takes into account all types of losses -- heat, hydraulic-fluid and working-fluid leakages. In the physical sense this is analogous to the efficiency factor of other gas turbine engine subassemblies (turbine, compressor, etc). Formulas are derived for determining the efficiency factor. The reasons for using this method are discussed, and sample calculations are given to demonstrate the advantage of using the energy efficiency factor for optimizing and comparing various types of heat exchangers. Comparative data on twelve parameters are tabulated for two types of GTD-GAZ and Ford 707 heat exchangers and three types of heat-pipe recuperators. Ill 2 Tab 1 Biblio 4

USSR

UDC 531.383

SOLUTIONS WITH INVARIANT CORRELATIONS TO SEVERAL PROBLEMS IN DYNAMICS OF SOLIDS

Moscow ISTORIYA MEKHANIKI GIDROSKOPICHESKIKH SISTEM [History of the Mechanics of Gyroscope Systems--Collection of Articles] in Russian 1975 pp 5-19

KHARLAMOV, P. V.

[Abstract] This article discusses studies devoted to the problem of arriving at and studying precise solutions to motion equations for a solid and systems of solids. Particular attention is given to methods suggested in recent years, such as the method of invariant correlations for arriving at solutions and the method of hodographs for studying the motion of a solid. Systematic use of the method of arriving at solutions with algebraic invariant correlations has increased substantially the number of precise solutions found to problems of solid-body dynamics. An outline of this method is given. A survey is given of precise solutions to motion equations for a gyrostat in a homogeneous field of force, and in particular for a heavy solid having a fixed point. Solutions are classified according to the degree of invariant correlation. The presence of a quadratic relationship makes it possible to reduce the problem to finding the square in the situation when the solid moves with a time constant. All solutions hitherto found with a quadratic invariant relationship are enumerated, all having been arrived at by a uniform method based on a single integrodifferential equation recently derived. Precise solutions to problems in dynamics of solids have become necessary owing to higher requirements for precision of gyroscopic instrumentation and its improved design, and as a result the modern theory of gyroscopic instrumentation is founded on strictly valid and complete equations. References 124: 115 Russian, 9 Western.

USSR

UDC 531.383

VIBRATING GYROSCOPES

Moscow ISTORIYA MEKHANIKI GIDROSKOPICHESKIKH SISTEM [History of the Mechanics of Gyroscope Systems--Collection of Articles] in Russian 1975 pp 43-60

BROZGUL', L. I., and SMIRNOV, YE. L.

[Abstract] Vibrating gyroscopes, which have been used in aeronautic and rocket engineering since the end of the 60's, satisfy to a considerable extent the requirements of small size, light weight, and low power drain imposed on integrating and differentiating gyroscopes used to solve a number of problems involved in controlling, guiding, and stabilizing aircraft. The operating principles of two types of vibrating gyroscope are discussed, the comparatively coarse oscillator-type first developed for automatic pilots, and the rotor-type, on the basis of which gyro stabilizers were constructed

to become components of control instruments for aircraft and inertial navigation systems. Differentiating and integrating modes of operation are demonstrated, using a rotor-type vibrating gyroscope as an example. A survey of the development and classification of the two types is given. Basic sketches of a rotor-type vibrating gyroscope are given, based on a system of equations describing the motion of a generalized model of a dynamically adjustable gyroscope. An analysis is made which takes into account angular and linear deformation of elastic elements, translational acceleration, external vibration, and instrumentation manufacturing tolerance. A mathematical description is given of the most widely used types of oscillator-type vibrating gyroscopes used in automatic pilots. A list of problems is given whose solution will be conducive to raising the precision of vibrating gyroscopes. They include developing new methods of reducing the influence of angular vibration, developing a theory of gyro stabilizers using different types of vibrating gyros as their sensitive element, developing methods of automatically maintaining resonant tuning of the sensitive element during temperature variation and ageing of materials, developing methods of dynamically balancing rotors using an elastic suspension, and developing new angular and linear low-amplitude vibration pickups, as well as developing new designs and selecting new materials to maintain shape, size, and elasticity while taking thermophysical, physical-mechanical, rheological, and other factors into account. Figures 11; references 33: 19 Russian, 14 Western.

USSR

UDC 539.1.074.5

USE OF GERMANIUM RADIATION DETECTORS AT LOW TEMPERATURES

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No. 4, Jul-Aug 76 pp 84-85
manuscript received 8 May 75

VYDRIK, A.A., Special Design Bureau for Engineering Cybernetics, Leningrad
Polytechnical Institute

[Abstract] A study is made of the recording capability of Ge(γ) detectors at 4.2 K and the detection of γ and β radiation. Seven detectors were studied with the following typical parameters: initial charge carrier concentration $n=8 \cdot 10^{12} \text{ cm}^{-3}$, dislocation density $\leq 100 \text{ cm}^{-2}$, resistivity at room temperature $\rho=50 \text{ ohm} \cdot \text{cm}$, capacitance of junction $C=7 \text{ pf}$ with bias voltage at least 50 V. The possibility is established of operation with germanium radiation detectors for nuclear radiation at 4.2 K. The amplitude of the photopeak is half that produced at 78 K, but the energy resolution changes little: from 3.5% to 4.5% at the γ radiation line of ^{137}Cs with energy $E_{\gamma}=662 \text{ KeV}$. It is shown that at 78 K, the detectors can record β particles with an energy resolution of at least $7 \pm 0.4\%$ at the line of β radiation of ^{137}Cs , energy $E_{\beta}=624 \text{ KeV}$. Thus, at the usual operating conditions, i.e., at 78 K, Ge(γ) detectors are quite suitable for recording of β particles, though it would be difficult to use them for high-resolution spectroscopy of conversion electrons. They can be used to record γ radiation due to the compensation at deep levels. Detectors of this type can withstand repeated cooling to 4.2 K and rapid heating to 300 K with no deterioration in working characteristics. 3 references.

USSR

UDC 621.378.3

MATRIX PYROELECTRIC RECEIVER FOR THE STUDY OF LASERS

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No. 4, Jul-Aug 76
pp 216-218 manuscript received 24 Oct 75

KRASOVSKIY, V.M., KREMENCHUGSKIY, L.S., SEMENOV, A.K., SHUL'GA, A.Ya.,
SHCHEREDIN, V.A., Institute of Physics, Acad. Sci. UkSSR

[Abstract] A description and results of investigation of 25- and 100-element matrix pyroelectric receivers for the diagnosis of lasers operating in the pulse mode are presented. The receivers consist of 25 or 100 independent channels, each of which has a band pyroreceiver and matching stage for a KP303 field-effect triode connected in an emitter repeater circuit. The receivers are designed for investigation of the space, power and time characteristics of lasers in the pulse and continuous modes. The dynamic range of energy linearity is 10^5 ; channel sensitivity is 7 V/J; the range of pulses recorded is 10^{-3} - 10^{-8} s; the filling factor of the receiver area with sensing

elements is 65%; the absorption capacity is at least 0.97 in the 0.4-20 μm spectral interval. A photograph and schematic diagram of the device are presented. 4 references.

USSR

UDC 536.62:539.89

INSTALLATION FOR MEASUREMENT OF ISOBARIC HEAT CAPACITY OF SOLIDS AT PRESSURES UP TO 250 MPa

Moscow PRIBORY I TEKNIKA EKSPERIMENTA in Russian No. 4, Jul-Aug 76
pp 232-234 manuscript received 5 Nov 75

MIL'NER, G.A., All-Union Scientific Research Institute for Physical Engineering and Radio Engineering Measurements

[Abstract] A calorimetric installation is described for measurement of the isobaric heat capacity of solids in the area of phase transformations at high pressures up to 250 MPa and temperatures from 150 to 350 K. The method of measurement is described. The primary specific feature of the method is the fact that the mass of pentanes in the calorimeter is variable. In order to eliminate the error resulting from nonconstancy of the mass, a calibration experiment is performed on several isobars with Cu, which has no phase conversions at this pressure level, its heat capacity depending little on pressure and having been tabulated in detail. Pressure pulsations are not over 0.01% at 250 MPa, the systematic error related to change in mass of medium transmitting the pressure is not over 2%, and the mean square deviation of experimental points from a curve smoothed by the method of least squares is 0.07%. Schematic diagrams of the calorimeter and bellows separator of the device are presented. 3 references.

USSR

UDC 539.172.3:539.2

INSTALLATION FOR MEASUREMENT OF THE MOSSBAUER EFFECT UNDER PRESSURE AT LOW TEMPERATURES

Moscow PRIBORY I TEKNIKA EKSPERIMENTA in Russian No. 4, Jul-Aug 76
pp 235-237 manuscript received 5 Nov 75

STEPANOV, G.N., PANYUSHKIN, V.N., Institute of High Pressure Physics, Acad. Sci. USSR

[Abstract] A method is described for mossbauer experiments under a pressure of up to 20 kbar at a temperature of up to 4.3 K. In contrast to earlier methods, the installation used in this method provides for constant measurement

of pressure by means of a manganin manometer, while the pressure gradients are slight, allowing the study of single crystal specimens. Cross-sectional views of the installation and its high pressure chamber are presented. 6 references.

USSR

UDC 538.56.029.6

CONTACTLESS MEASUREMENT OF HETEROGENEITIES OF DISTRIBUTION OF CONCENTRATION OF CURRENT CARRIERS IN THE VOLUME OF NARROW-ZONE SEMICONDUCTORS

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No. 4, Jul-Aug 76
pp 241-242 manuscript received 3 Nov 75

LAURINAVICHYUS, A.K., POZHELA, Yu.K., Institute of Semiconductor Physics,
Acad. Sci. LitSSR

[Abstract] A device is suggested for measurement of heterogeneities in the distribution of free charge carriers in narrow-zone semiconductors. The effect of the device is based on the use of helicon waves in the SHF band. The wavelength of the helicon in the semiconductor at the frequency used depends primarily on the external magnetic field and the concentration of charge carriers. If the specimen is a plane-parallel plate, a standing helicon wave may arise within it. In this case, a change in external magnetic field leads to a resonant dependence of transmission factor (or reflection factor) of the incident wave. The resonant nature of these dependences results from the development of Fabry-Perot resonances when a whole number of half waves fall within the thickness of the specimen. The resolving capacity in the 2 mm waveband is 0.2 mm as to coordinate and about 1% as to heterogeneity of distribution of charge carrier concentration. 7 references.

USSR

UDC 62-50

USE OF POLARIZATION-OPTICAL METHOD FOR REMOTE SENSING AND
CONTROL OF THE ANGLE OF ROTATION OF OBJECTS

Novocherkassk IZVESTIYA VUZOV ELEKTROMEKHANIK A No 5, 1976
pp 540-546 manuscript received 29 Nov 74, revised 30 Jul 75

NIKITENKO, N.F.

Abstract The author proposes that the three-dimensionality of a polarized light wave be exploited for designed optoelectronic devices for measuring angles of rotation. A block diagram and characteristics are given for a modulation-type polarization angle of rotation meter. The selection of optimum scanning amplitude is discussed on the basis of an analysis of the modulation characteristics of conversion from the point of view of reducing the noise level and increasing sensitivity. Experimentally obtained characteristics are given for the proposed modulation-type polarization angle of rotation meter based on the use of a laser and lithium niobate cells. Ill 3 Biblio 7

USSR

UDC 536.212

THERMAL CONDUCTIVITY OF FREONS F-12V1 and F-13V1

Minsk IZVESTIYA VUZOV ENERGETIKA No 8, 1976 pp 91-95
manuscript received 6 Apr 76

GELLER, V.Z., EIZENBEYS, V.P., and VOYTENKO, A.K.

Abstract A description is given of test cells for studying the thermal conductivity coefficient by a method using coaxial cylinders. The temperature field of the test cells is analyzed. Results are given of a measurement of the thermal conductivity of freons F-12V1 and F-13V1 by the coaxial-cylinders and hot-wire methods in the temperature range of -167 to 160°C and at pressures of up to 60 Mpa. The results obtained by the different methods are tabulated and analyzed. The values obtained by the hot-wire method are 2-4% lower than those obtained with the coaxial cylinders. This discrepancy is comparable to the total error of both methods, and may be due to different values of radiation heat transfer associated with the different geometries and optical properties of the working surfaces. Ill 1 Tab 3 Biblio 4

USSR

UDC 537.227.001.5

SIMPLE INSTALLATION FOR STUDYING THE PYROELECTRIC EFFECT

Moscow METROLOGIYA in Russian No 9, 1976 pp 31-33

TISHCHENKO, V. S., MOROZOV, YE. M., and ORANSKIY, L. G.

[Abstract] On the basis that experimental installations for both dynamic and static studies of the pyroelectric effect are cumbersome and the measurements obtained with them are difficult and time-consuming, the authors have devised a simple installation made up of standard units which can produce automatic measurements of the dependence of the pyrocharge and pyrocurrent intensity on temperature. The main unit is a modified U7-2 operational amplifier. The measurement error does not exceed 2%. With a slight modification of circuitry one can record the temperature dependence of the resistance logarithm within the limits of $10^5 - 10^{14}$ ohms.
Ill 1 Biblio 2

USSR

UDC 621.317.714-182.6

A MORE ACCURATE AND SENSITIVE MAGNETIC MODULATION CLIP-ON CURRENT TESTER

Moscow PROMYSHLENNAYA ENERGETIKA in Russian No 2, Feb 76 pp 12-14

TARKHANOV, O.V., candidate of engineering sciences, and GIZATULIN, R.M., engineer, Chirchik Electrochemical Combine

[Abstract] A description is given of a new design of a current tester based on the principle of magnetic modulation, used for measuring and monitoring direct current. Other clip-on current testers of this type have comparatively low sensitivity, owing to the fact that the two pairs of a.c. coils located on a single closed core are connected in opposing fashion. The new tester eliminates this situation by using a separate magnetic circuit for the two arms of the active coils. The tester consists of two closed O-type magnetic circuits placed one on top of the other and interconnected magnetically at their faces. On one face the magnetic circuits' generating lines are surrounded by two pairs of coils placed one on top of the other. These are connected to the opposite arms of a bridge so that the magnetic flux from one pair of coils is guided to match the flux from the current being measured, and the flux from the other pair of coils to oppose this flux. A detailed analysis is given of the new tester's operating parameters and electrical characteristics. This new design makes it possible to achieve high sensitivity and accuracy and to practically eliminate stray flux, resulting in higher efficiency. The tester measures 200 X 80 X 60 mm, without handles, making it possible to monitor current up to 1500 A in busbars measuring 130 X 20 mm in cross section. Development work is presently being done on a tester for measuring current in the range of 1500 to 3000 A. Figures 4; references 4: 4 Russian.

ENSURING UNITY IN MEASUREMENTS OF SEA WATER CONDUCTIVITY FLUCTUATIONS

Moscow METROLOGIYA in Russian No 8, 1976 pp 9-15

KHAZHUYEV, V. N., and KHAKHAMOV, I. V.

[Abstract] A great deal of methods and equipment has been developed to measure conductivity pulsations, but in spite of the vast inventory of pulsed conductivity bridges in use there is an absence of a metrological base, i.e., of a testing system and legitimate testing equipment and methods, for testing this measuring equipment. Hitherto there has been no insurance of unity in measurements of conductivity pulsation values in conductimetric analysis of sea water. This has sometimes led to incorrect interpretation of data obtained by different researchers. Standard instrumentation is necessary to make it possible to calibrate and test measuring equipment used to determine both mean and pulsation values of sea water conductivity, for the purpose of detecting and taking into account systematic errors resulting from the hydrodynamic effect of the current on the primary measuring transducer. Primary transducers developed by different organizations have also had shortcomings. A description is given of a standard capillary transformer-type transducer developed at the All-Union Scientific Research Institute of Metrology imeni D. I. Mendeleev, making possible a high degree of measurement precision with high three-dimensional resolution. It has been found that this transducer in conjunction with a measuring bridge makes it possible to convey true conductivity values from standards reproducing a standard unit of conductivity to standard and working equipment for measuring conductivity pulsations. An arrangement for a testing system for equipment for measuring conductivity pulsations is suggested. This system is recommended as a supplement to an earlier-proposed system for testing equipment for measuring mean conductivity values. The system suggested consists of four components: Standard units of measurement for constant conductivity, first- and second-class standard measuring instruments, and working equipment for measuring conductivity pulsations. A description is given of the individual components of this system and of their parameters. The equipment described makes it possible to measure conductivity pulsations in the range of 0 to 300 Hz. Figures 2; references 6: 5 Russian, 1 Western.

USSR

UDC 778.37

DEVELOPMENT OF VSFK-5 DRIVEN-TYPE HIGH-SPEED WIDE-ANGLE CAMERA

Moscow ZHURNAL NAUCHNOY I PRIKLADNOY FOTOGRAFII I KINEMATOGRAFII in Russian
Vol 21, No 5, Sep-Oct 76 pp 368-371 manuscript received 5 Nov 75

DUBOVIK, A.S., BALYGIN, A.K., BARANOV, S.V., BELINSKAYA, G.I., VESELOVSKAYA, V.M., GANOKHIN, N.D., KUZ'MIN, B.P., and SEMENOV, A.K., All-Union Scientific Research Institute of Optical Physical Measurements

[Abstract] A description is given of a unique driven-type high-speed, wide-angle camera, the VSFK-5, which operates in both the visible and infrared region of the spectrum (to 2500 nm). It is designed for use in studies of rapidly occurring processes over a wide spectral range and features a 22 X 16-mm frame. The camera has two optical channels whose axes are parallel. All optical system components were newly developed for this camera, with the exception of the two "Industar-23" objectives used as inlet components. Rays of light from the object being photographed pass through the objectives of both channels and an image is made within field stops which determine the frame size. A field lens picks up the image and passes it along to an aperture stop acting as the entry pupil for the optical channel, where a system of lenses relays the image to the rotating mirror faces of a four-sided mirror. Two such mirrors are used, intersecting one another, one operating in each channel, both channels being identical in all respects. Light beams reflected from the individual faces of the revolving mirrors strike the objectives of a lens mounting which relays the intermediate image formed in the area of the faces of the polyhedral mirror system to the camera's focal surface, to which the film is attached. Images from the inlet pupils move through the objectives of the lens mounting and as they are lined up with each objective a separate frame is exposed. A special high-speed spark-gap shutter is used, which has been rated as fast as 40 microseconds under specific conditions. Two rows of frames are shot in succession, resulting in a total operating angle of 180°. Resolution at frame center is no less than 20 lines/mm, and at frame edge 15 lines/mm. Operation in the infrared region entails the use of the same optical system, the components being moved along the optical axis to conform with readings on special scales. A special device is provided for combining the pupils of both channels into a single pupil, making it possible to use this camera with instruments with one pupil. Sets of filters are also provided, making it possible to extend the exposure scale and to operate in strictly defined sections of the spectrum. The camera is controlled from an electronic control panel, which is used to start and speed up the electric motor, stabilize the five speeds for revolving the mirror, and control the safety and high-speed shutters. This camera can be used to measure speeds of processes ranging from 25 to 7,500 m/s. Figures 2.

USSR

UDC 621.438: 621.43.056

TESTING THE ANNULAR COMBUSTOR OF THE NK-8 AIRCRAFT ENGINE ON
NATURAL GAS

Moscow TEPLOENERGETIKA No 8, 1976 pp 60-64

TUMANOVSKIY, A.G., KOVALEV, V.N., SKURIDIN, V.G., and
MINGALEYEV, F.M.

[Abstract] On the basis of the fact that the NK-8 turbofan engine installed on the IL-62 and TU-154 aircraft could be used widely as a stationary power source in the national economy the authors conducted an experimental study of the main characteristics of the annular combustion chamber operating on natural gas. It was found that such a use could essentially reduce the heat load on the combustion chamber and its dimensions, and simplify the over-all characteristics of the gas turbine stationary power installation. In some modes a gas temperature of $1,350^{\circ}\text{C}$ was achieved at 100% combustion, with a 3% relative pressure loss, a 16-18% temperature-field difference factor, and a maximum flame-tube wall temperature of 750°C . Ill 5 Biblio 2

CSO: 1861

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